RIO BLANCO OIL SHALE COMPANY

# PROGRAM FOR PRODUCTION OF SYNTHETIC FUEL AT TRACT C-a

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Rio Blanco Oil Shale Company
Planning and Economics Department
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# RIO BLANCO OIL SHALE COMPANY
# PLANNING AND ECONOMICS DEPARTMENT
# PROGRAM FOR PRODUCTION OF SYNTHETIC FUEL AT TRACT C-a

## OVERVIEW

Rio Blanco Oil Shale Company (Rio Blanco) is a general partnership of Gulf Oil Corporation and Standard Oil Company (Indiana). The partnership was formed to develop Tract C-a, a parcel of 5089 acres of oil shale land located in western Colorado, as shown on Figure 1, attached. The tract was leased from the Federal Government on March 1, 1974 as part of the initial prototype oil shale leasing program. A total of $210 million was bid for the lease; $126 million was paid in cash, $84 million was offset through development expenditures. To date, almost $400 million has been committed to project development. In addition to financial support, Rio Blanco receives the full commitment of Gulf and Standard's management and research expertise. Rio Blanco's program for producing synthetic fuel from oil shale at Tract C-a is based on a plan which positions Rio Blanco to make a decision to proceed with commercial construction after:

(1) technology is developed, and
(2) permits for commercial operation are secured.

Rio Blanco is currently pursuing the development of two alternative technologies--Modified In Situ (MIS) and Lurgi/Open Pit.

## TRACT C-a RESOURCE

The amount of shale oil estimated in place on the tract totals 9 billion barrels of crude oil equivalent. The amount of oil which is recoverable depends on the mining and retorting technique. For an open pit mine with surface retorting, an estimated 5 billion barrels are recoverable

# LOCATION MAP OF TRACT C-a

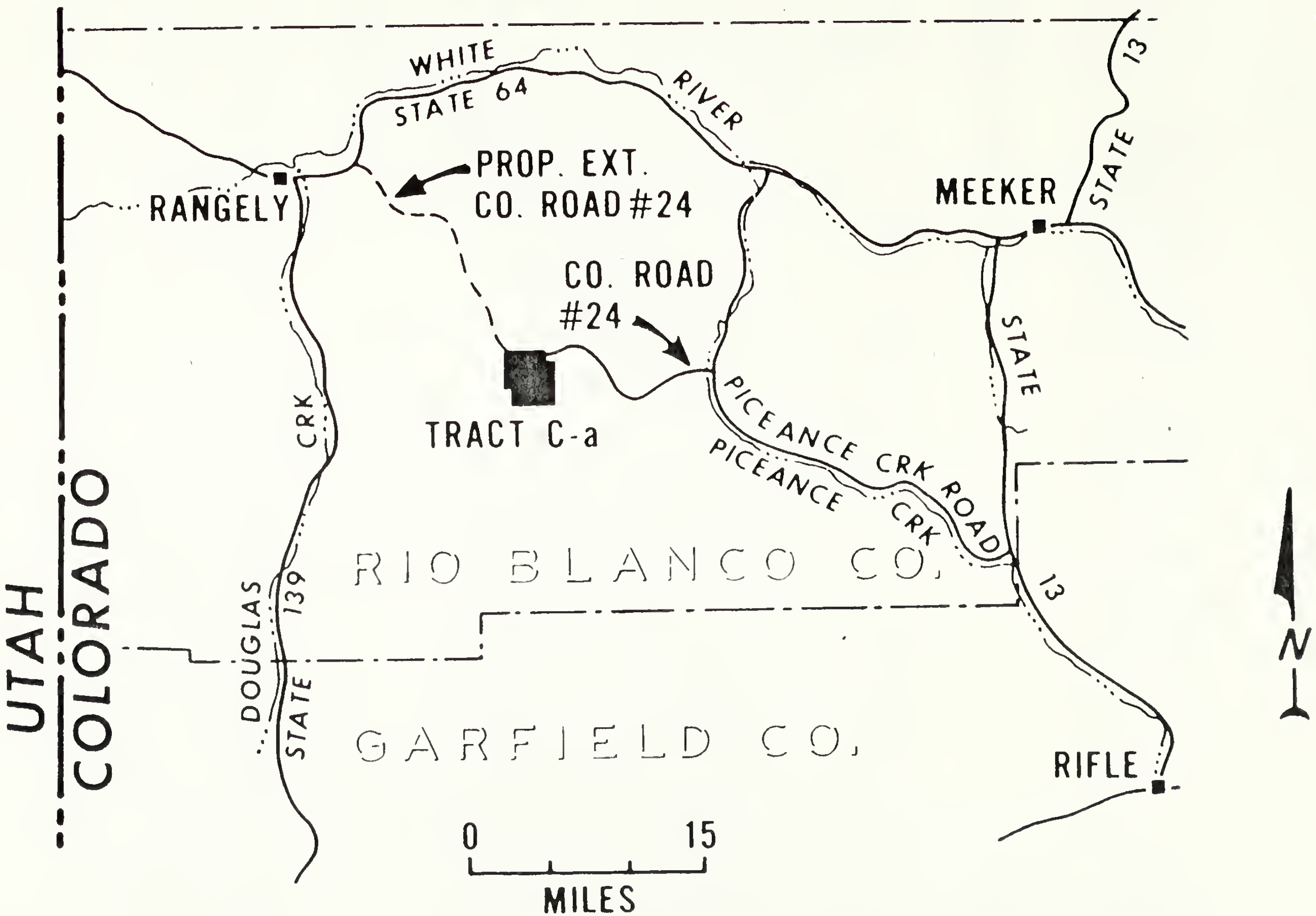



FIGURE 1

from Tract C-a. Initial commercial production and maximum productive potential at Tract C-a remains to be decided as detailed engineering develops. With an open pit option initial production could range up to 50,000 BPD in the late 1980's with perhaps 300,000 BPD achievable in the mid to late 1990's.

The Detailed Development Plan covering modified in situ retorting projected a production rate of 76,000 barrels per day. An estimated 2 billion barrels are recoverable at Tract C-a with the MIS option.

## MODIFIED IN SITU OPTION

Rio Blanco is three years into a four year demonstration of modified in situ (MIS) technology. This program involves burning progressively larger underground retorts. The first retort, which was ignited on October 13, 1980, was designated Retort Zero. In size, it is 30 by 30 by 164 feet. The Retort Zero test burn was completed on December 20, 1980. Rio Blanco was pleased with the results of this test, which reasonably met all objectives. The next MIS retort burn in the current program is expected to be completed by year end 1981. The estimated cost of the MIS project through year end 1981 is approximately $140 million. Figure 2, attached, is an aerial view of surface facilities which serve the MIS program.

## LURGI SURFACE RETORT

The second program now in progress at Rio Blanco is the construction and operation of a 4,400 ton-per-day (2,000 BPD) surface retort. Rio Blanco needs to develop Lurgi surface retorting for both the MIS and Lurgi/Open Pit optional plans. The retort would be fed by a small open pit developed on Tract C-a. Lurgi engineering has been underway since early 1980. Lurgi retort operation is scheduled to begin mid-1983. The technology chosen by Rio Blanco for surface retorting was developed by Lurgi Kohle und Mineraloltechnik Gmbh, a German firm active in synfuel technologies. Many details of the Lurgi process are proprietary and confidential. However, the key equipment components utilized in this

TRACT C-a MIS SURFACE FACILITIES

FIGURE 2

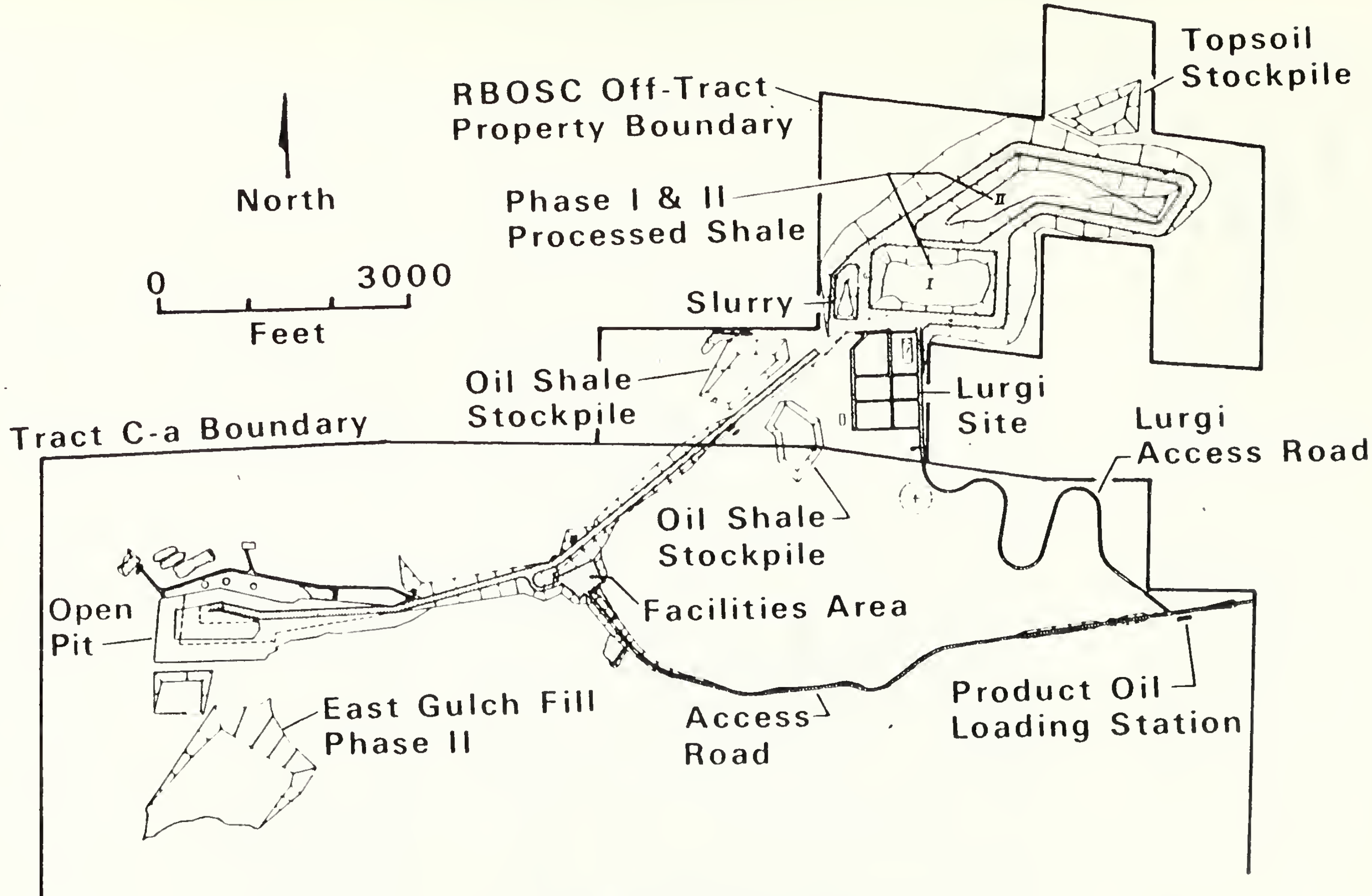
process have been commercially proven in a number of installations and applications around the world including the devolatilization of coal. Pilot plant runs have confirmed the applicability of Lurgi processing concepts and equipment configuration to the retorting of shale.

Figure 3, attached, is a plot plan of the Lurgi facilities, an open pit mining operation, retort feed preparation, the Lurgi Retort and the processed shale disposal area. A brief description of each area (as preliminarily designed) is as follows:

A. Mining - The Lurgi open pit mine will utilize conventional shovel/-truck mining methods to expose and mine 3.0 million tons of oil shale. It will be located in the northwest corner of Tract C-a adjacent to the Dry Fork of Corral Gulch.

The pit development will proceed in two phases. Phase I will be a 20 month operation in which approximately 5.2 million cubic yards of overburden will be removed to mine 1.2 million tons of oil shale. Phase II will be an 18 month project involving the removal of 4.2 million cubic yards of overburden to mine 1.8 million tons of oil shale. The Phase II operation will expand the south and west highwalls of the Phase I pit to expose the 1.8 million tons of shale. Total pit disturbance for Phases I and II will be 24 acres and 12 acres respectively, for a total of 36 acres. Mined oil shale from the Phase I and II pits will primarily come from the Mahogany zone.

B. Retort Feed Preparation - Crushing and screening equipment prepares 400 TPH of nominal ¼-inch product for retort feed. The systems operate in closed circuit with double-deck vibrating screens. The feed shale is weighed and conveyed to an enclosed storage facility. Automatic reclaiming is provided under the storage pile at the rate of 185 TPH and is sampled and fed to the retort unit by a gravimetric weigh feeder.




**Lurgi Project Plan**
**Major Facilities**

FIGURE 3

C. Processed Shale and Overburden Disposal - The processed shale and overburden disposal system is designed to evaluate disposal techniques and to collect pertinent data which will be used to optimize the design and operation for the processed shale disposal system for the Commercial Project. The disposal plan for Phase I is keyed to mining and retorting production schedules. Mining and disposal of overburden is scheduled to begin January, 1982. Disposal of processed shale is scheduled to begin when the Lurgi Retort is operational.

D. Lurgi Retort - Figure 4, attached, is a simplified flow diagram of the Lurgi Process. In the Lurgi process, properly sized raw shale will be delivered to a feed bin at the top of the process tower. From the feed bin the feed shale is delivered to the Lurgi mixer where it is mixed with hot, recycled, processed shale and is heated to retorting temperature. At this temperature hydrocarbon vapors are released from the oil shale. The products of the retorting process are then passed through an oil condensation section which recovers the raw shale oil in various fractions. The heavy oil fraction contains fine particles of processed shale which are removed in the heavy oil dedusting area. The oil products are ultimately delivered to product storage tanks from which they are transported by tank trucks for delivery to markets.

The mixture of hot solids falls from the Lurgi mixer to a surge bin from which it enters the lift pipe. There it is contacted by a hot air stream to initiate combustion of the coke remaining on the shale and is lifted to the collecting bin. Residual carbon on the "fresh" processed shale will be burned as the material is lifted, along with auxiliary fuel as necessary.

As the hot processed shale stream reaches the collecting bin, a measured portion falls to the bottom of the collecting bin, completing the Lurgi loop while the remainder continues out of the collecting bin with flue gas to heat air and generate steam.

# Lurgi-Ruhrgas Oil Shale Retort

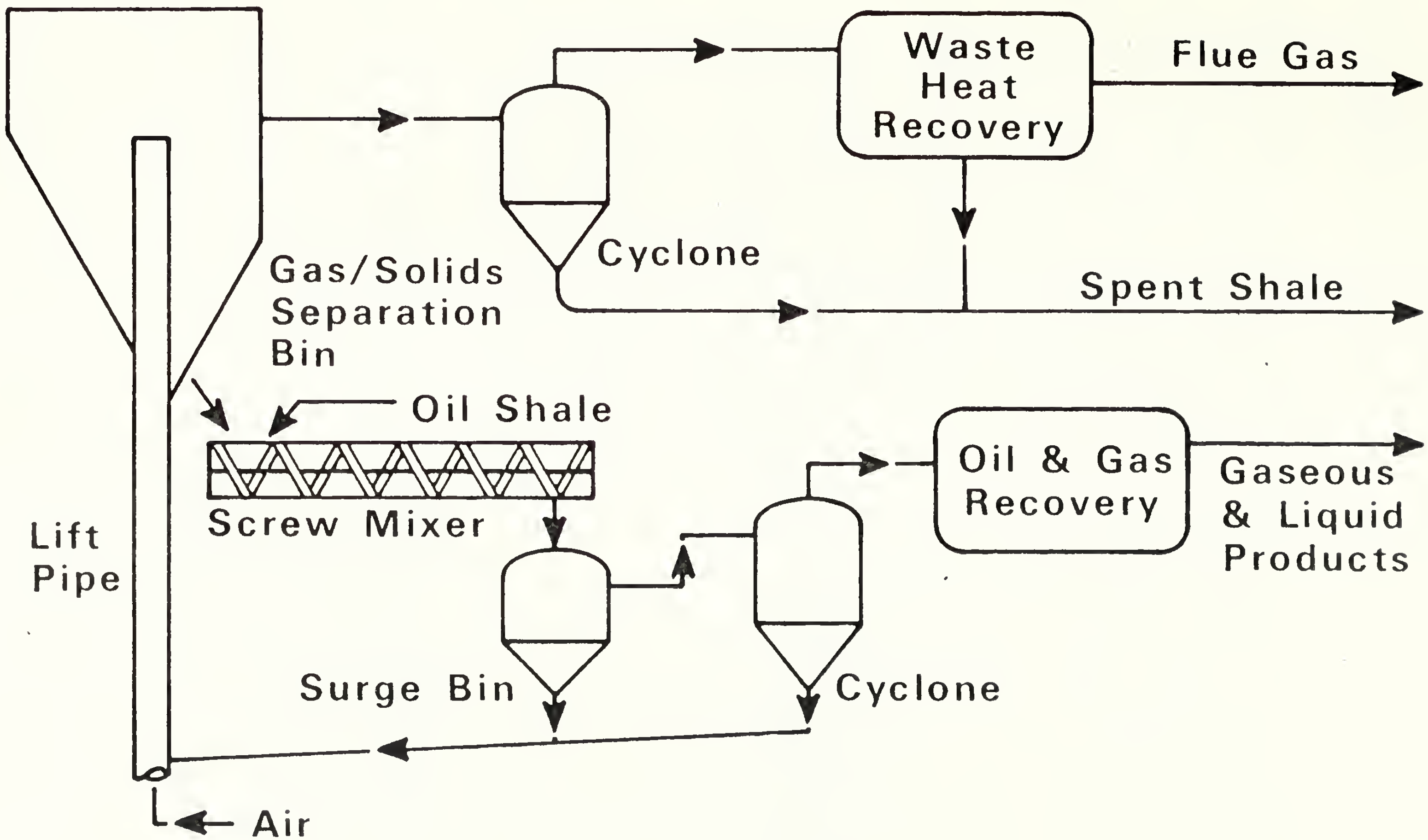



FIGURE 4

In the heat recovery area, the flue gas/processed shale mixture flows through an air preheater and a steam generator. The cooled mixture will pass through cyclones and an electrostatic precipitator for the removal of particulates prior to emission of the flue gas to the atmosphere through the stack.

The processed shale, which has been collected in several locations, is delivered to a processed shale cooler and then to a moisturizer. From there it goes to a conveying system for transport to the disposal area. A very comprehensive program for assessing the environmental impacts of disposing of Lurgi processed shale is included in the Lurgi development program scope.

## COMMERCIAL ENGINEERING AND PERMITTING

Rio Blanco will complete an evaluation of both MIS and Surface Retorting/Open Pit technologies. However, we currently believe an open pit/-surface retorting approach has the following advantages over Modified In-situ Technology as applied to Tract C-a.

- Greater resource recovery;
- Greater producing rate potential;
- Less technical uncertainty; and
- Less long-term environmental impact.

Therefore, Rio Blanco's commercial effort focuses on a Lurgi retorting/-open pit mining program. In July, 1980, Gulf and Standard Oil (Indiana) provided $13 million in funding for the initial phase of the Rio Blanco commercial project. This initial phase comprises preliminary engineering and the preparation of permit applications for a facility with an initial capacity increment in the 50,000 BPD range to be brought on-stream in a 1987-88 time frame.

The decision to proceed with commercial construction has not been made. This decision will not be made until technology has been further developed.

A preliminary casting of the timing of various elements of Rio Blanco's commercial project is detailed in Figure 5, Rio Blanco's development schedule, attached. As the schedule indicates, permit-related efforts are underway. Beginning in 1982 and overlapping the permitting activity, approximately five years are provided for detailed engineering design, mine development, and initial construction of a capacity increment in the range of 50,000 BPD.

Our preliminary commercial design plans indicate two years will be required to pre-strip overburden to start a commercial scale open pit operation.

Rio Blanco's preliminary commercial mine development design employs proven technology...conventional bench blasting, loading of overburden and ore with 30-yard shovels loading into 170-ton trucks. Ore is crushed by in-pit primary crushers; overburden in pit-rim crushers. Our design provides for ore transfer via covered conveyors with bag house equipped transfer points to enclosed secondary and tertiary crushing and screening facilities. The equipment configuration--trucks, shovels, conveyors, etc., required upstream of retorting are all commercially proven equipment.

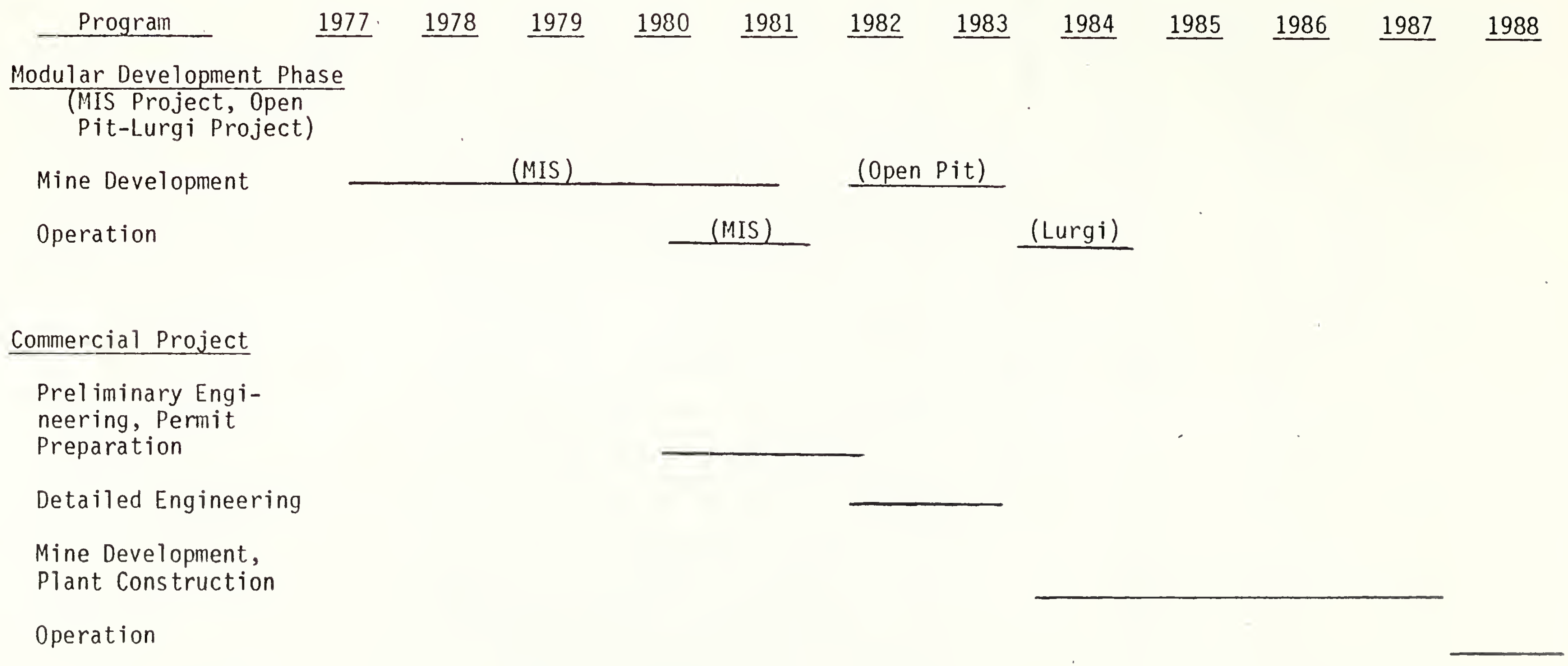
The operability of commercial Lurgi retorts would be proven by our Lurgi development program now underway. In our initial concept, raw shale oil from the Lurgi process is upgraded to synthetic crude in full shale oil hydrogenation facilities. The upgraded syncrude is fungible with crude oil and would be sold or transferred to the Rio Blanco partners at the Tract C-a gate.

A new industry pipeline would connect with existing crude oil pipelines which will deliver syncrude to user refineries. Refinery processing will yield transportation fuels and other products.

Lurgi spent shale (the principal waste material) is conveyed with pit overburden to a processed shale disposal area. Environmental considerations involved in processed shale disposal and other environmental

RIO BLANCO OIL SHALE COMPANY

PRELIMINARY DEVELOPMENT SCHEDULE




Note: Schedule assumes necessary funding is available and that there are no major permit or litigation delays.

FIGURE 5

matters relating to commercial operations at Tract C-a are addressed by our Lurgi development program. A very generalized input-output material balance for a 50,000 BPD commercial oil shale retort configuration at Tract C-a would show approximately 100,000 TPD of shale input (Tract C-a is the source), resulting in approximately 50,000 BPD of output and the generation of approximately two tons of spent shale waste per barrel produced.

All of the above description of our commercial plan will be refined and revised as engineering progresses.

## ENVIRONMENTAL IMPACTS AND REGULATORY REQUIREMENTS

Technologies currently included in Rio Blanco's development program... modified in situ, open pit mining and surface retorting...were covered in the 1973 Interior Department EIS. Subsequent to the 1974 lease acquisition, Rio Blanco completed two years of environmental baseline studies. These studies plus continuing environmental monitoring provide a comprehensive scientific data base for evaluating the effects of C-a development. Rio Blanco's environmental program has addressed the mitigation of environmental impacts in the various ecological disciplines as well as air and water quality. For example, revegetation studies have been underway for several years on Tract C-a. Key environmental permits have been secured for the MIS program, have been applied for relative to the Lurgi program (under the auspices of the Colorado Joint Review Process) and are under development for the commercial project. To date, Rio Blanco has successfully met all local, state and federal regulatory requirements.

## SOCIOECONOMIC IMPACTS

The Colorado communities of Rifle, Meeker and Rangely are expected to experience significant growth from the development of Tract C-a. However, Tract C-a has contributed substantial funding for the the mitigation of impacts. Colorado's Oil Shale Trust Fund was created by the placement of some $47 million from the monies paid the federal government by Gulf and Standard in leasing Tract C-a. The distribution of

population resulting from Rio Blanco's work force will depend on infrastructure construction. A commercial scale production level of 50,000 barrels per day would result in a peak construction employment of approximately 3,000 workers during the middle years of construction (their skill level to be determined as detailed engineering progresses) and a permanent employment of under 2,000 workers. Rio Blanco's socioeconomic contribution to the Trust Fund, therefore, approximates $23,000 per permanent worker. In addition to the $47 million in the Trust Fund attributable to C-a, Rio Blanco has developed, at additional expense, housing and transportation plans for its workers; for example, the company underwrote a mobile home park in Rangely; we own in fee a trailer park site near Meeker; and more than 90% of Tract C-a employees are transported to and from work by buses and vans. Rio Blanco Oil Shale Company continually works with state and local officials in identifying socioeconomic impacts and in planning mitigative measures. This effort will continue.

## WATER RESOURCES

Two prolific aquifers exist on Tract C-a which are denoted the "Upper" and "Lower" aquifers. Modified In-Situ operations have required substantial dewatering of the upper aquifer. Both upper and lower aquifers would be intersected in a commercial open pit. Rio Blanco's Commercial Project would be a net consumer of water. Rio Blanco development programs previously described, will quantify our requirements. A water augmentation plan, filed with Colorado Water Court, would assess impacts of development on other users and mitigation measures would be subject to court review and approval. Rio Blanco holds an option on industrial water rights on the White River which could be exercised in whole or in part when water requirements are quantified. Various industry sources have indicated a range of up to five barrels of water required per barrel of oil produced by a shale project.

## MAJOR SUBCONTRACTORS INVOLVED

Morrison-Knudsen Company, Inc. is Rio Blanco's managing contractor for the MIS program and the mining aspects of the Lurgi program.

C. E. Lummus is the design contractor, assisted by Morrison-Knudsen, Lurgi, Zachry and numerous others on various aspects of the Lurgi program and the preliminary efforts on the commercial program.

## REPRESENTATION REGARDING ENERGY SECURITY ACT

Rio Blanco will meet the necessary conditions and requirements of the Energy Security Act as a condition of receiving financial assistance.

## RISKS WITH RESPECT TO COMPLETION

The Rio Blanco commercial project has an opportunity to exploit a resource of extraordinary size, 9 billion barrels, concentrated on 5000 acres. A conservative coupling of proven mining technology with the resolution through demonstration of uncertainties in the processing and environmental areas will underlie our commercial project. The risks within our control--the technological risks, are being addressed by our program. The risks under the control of government...the risk of regulatory delay related to securing permits for construction and operation...the risk of rampant inflation resulting in cost overruns... the risks of government control of synfuel pricing...these risks and others are a proper subject for possible mitigation by a structured financing plan.

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